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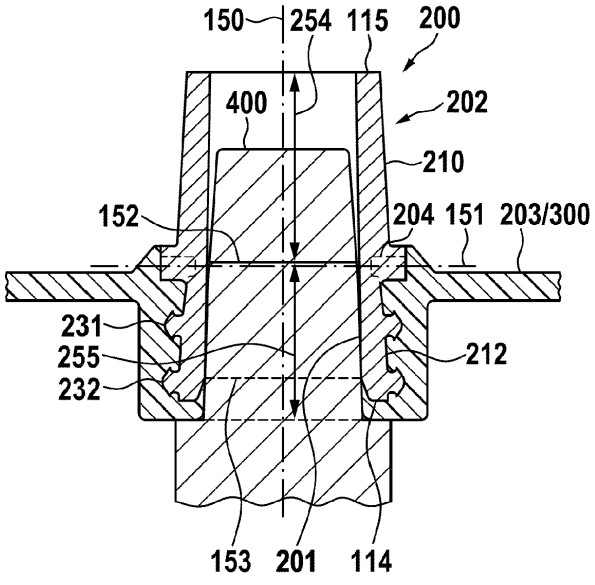
(54) **BATTERY BUSHING WITH INTERNAL ANTI-TWIST PROTECTION**

(57) A battery bushing for a rechargeable battery has a mounting section and a contacting section. There is a torque ring, between the mounting section and the contacting section. The torque ring or the outer surface itself can be endowed with several indentations. The mounting section is for holding the battery bushing within a battery cover, into which it preferably is injection molded. The battery bushing is a hollow body, which has an outer wall and an inner wall. At the contacting section, the outer wall is conically shaped. At the mounting section, the outer wall has at least one circumferential projection forming a labyrinth. The inner wall comprises at least two sections. An upper section is approximately surrounded by the contacting section, and preferably has a conical shape. A lower section is approximately surrounded by the mounting section. The lower section preferably has in a lateral sectional view a concave shape. Between the upper section and the lower section, there may be an edge or a step.

Fig. 1



EP 3 133 674 A1

Description

Field of the invention

[0001] The invention relates to battery bushing s for rechargeable batteries, also called connecting poles, for rechargeable batteries, particularly for connecting poles of batteries, specifically lead acid batteries, also called rechargeable batteries. Another aspect of the invention relates to covers for housings and/or housings of such batteries and such batteries.

Description of the related art

[0002] A battery bushing for a rechargeable batteries which can be molded into the rechargeable batteries lid and has a plurality of grooves forming a labyrinth seal, is disclosed in the European patent publication EP 0 601 268 B1.

[0003] The US patent 7,517,610 B2 discloses a rechargeable battery having poles with a sliding element within a lower section of the poles to simplify the insertion of a battery's pole shank by reducing the friction between the pole shank and the battery bushing. If this sliding element is integrally formed on the battery cover, injection molding of the battery cover is comparatively complex and requires expensive precision tools to form a thin sliding film at the inner side of a pole sleeve.

[0004] In the US patent publication US 6,030,723, a lead bushing is disclosed, which is connected to a terminal post of a battery by a conductive adhesive. To simplify insertion of the terminal post into the lead bushing, the terminal post has a significantly smaller diameter than the lead bushing. The gap between the terminal post and the lead bushing is filled by said conductive adhesive.

[0005] The European patent application publication EP 2814077 A1 discloses a battery bushing for a rechargeable battery which has a mounting section and a contacting section. There is a torque ring between the mounting section and the contacting section, which preferably has tooth-shaped protrusions. The mounting section is for holding the battery bushing within a battery cover, into which it is injection molded preferably.

[0006] DE 10 2010 033 645 A1 discloses a battery bushing for a rechargeable battery which has a mounting section and a contacting section. There is a torque ring between the mounting section and the contacting section, which has tooth-shaped protrusions. The mounting section is also tooth shaped for holding the battery bushing within a battery cover, into which it is injection molded preferably.

[0007] In the US patent publication US 2011/0250493 A1 discloses a battery bushing for a rechargeable battery which has a mounting section and a contacting section. There is a torque ring between the mounting section and the contacting section, which has a groove and a step at the upper side. The groove leads to notch stress to the material of the battery post and the material of the battery housing and therefore enables a premature failure. Furthermore the torque ring comprises several recesses which are not parallel. This makes the demolding process much more complicated and leads to a more complex and expensive molding tool.

[0008] The European patent application publication EP 1 347 522 A1 discloses in figure 1 a battery bushing post with a circumferential section which has a saw tooth-shaped longitudinal profile. The profile protrudes over the surface of the battery bushing post and generates notch stress. The saw tooth forms a step which prevents a plane support for the injection molding tool.

Summary of the invention

[0009] The problem to be solved by the invention is to provide a battery bushing for rechargeable batteries, which provides an improved sealing and an improved mechanical stability. Furthermore, the battery bushing should allow easy assembly of the rechargeable batteries and therefore inserting of the terminal post into the battery bushing during assembly with a low friction. The process of manufacturing the battery bushing and the process of injection molding a battery cover should be simplified and should be made more precise. The amount of material for the battery bushing should be reduced.

[0010] The solutions of the problems are described in the independent claims. The dependent claims relate to further improvements of the invention.

[0011] In a first embodiment, a battery bushing, preferably for a rechargeable battery, has a mounting section and a contacting section. There is an outer wall of the battery bushing between the mounting section and the contacting section which has several indentations. In an alternative embodiment an annular base which may be a separate part or may be part of the outer surface may have a plurality of indentations. The mounting base may protrude from the outer wall.

[0012] The indentations, which also may be recesses, may have various shapes. In a preferred embodiment the indentations have a shape such that the battery bushing can be demolded easily. Notch stress may be reduced by rounding the edges. The form of the indentations may be adapted to the special requirements related to the encapsulation material, like plastic, resins or metal, or the mechanical requirements. An advantage of the use of indentations is that the amount of material which is needed for the production will be reduced and the demolding will be simplified. In a further preferred embodiment the indentations have an approximately parallel orientation. The approximately parallel indentations can be seen as slots which correspond approximately to the inner contour of one half of the two part molding tool. This feature simplify the production process such that an only two-part molding tool is needed.

[0013] The battery bushing may be attached to the battery terminal post. After mounting the battery bushing it may be overmolded with plastic or other materials so that

the indentations will be filled by the material. The indentations may therefore act as spin-lock.

[0014] The mounting section is for holding the battery bushing within a battery cover, into which it preferably is injection molded. The battery is externally connected by the contacting section. The battery bushing is a hollow body, which has an outer wall and an inner wall. At the contacting section, the outer wall preferably is conically shaped with decreasing diameter to the upper side of the battery bushing. At the mounting section, the outer wall preferably has at least one circumferential projection, or protrusion, forming a labyrinth. The inner wall comprises at least two sections. An upper section is approximately surrounded by the contacting section, and preferably has a conical shape with decreasing diameter to the top side of the battery bushing. It may also has a cylindrical shape. A lower section is approximately surrounded by the mounting section. The lower section preferably has a lateral sectional view with a concave or conical shape which extends or increase in the direction of the bottom side. Between the upper section and the lower section, there may be an edge or a step at the inner wall of the battery bushing.

[0015] The lower section may have a straight or concave shape of the inner wall and can provide space for plastic material of the battery cover. While battery bushings as known in the prior art are only held by their outer walls within the battery cover, this embodiment of a battery bushing is completely embedded into the material of the battery cover in its mounting section, including the outer wall and the inner wall of the battery bushing. This gives enhanced stability to the battery bushing and results in a significantly higher retention force. This is not comparable to thin sliding elements. In contrast thereto, there is space for a significant layer of the battery cover's material covering the inner wall of the battery bushings mounting section. The thickness of the battery cover's material may be 1 mm or more, preferably 3 mm. For molding a battery bushing into a battery cover, a pin of a molding tool is inserted into the battery bushing to limit the flow of the battery cover's material within the battery bushing. A circular edge at the inner wall of the battery bushing between the upper section and the lower section is in contact with the pin of the molding tool and ensures sealing of the area into which the battery cover's material can flow. This results in a clear limit of the battery cover's material to the lower section of the battery bushing.

[0016] The circular edge preferably is pressed against the pin of the molding tool. To obtain a secure sealing, the pin of the molding tool must at least closely fit into the diameter of the circular edge. The pin of the molding tool may also be pressed into the battery bushing, extending the inner diameter of the circular edge slightly. Therefore it is preferred, if the circular edge is opposed to the protrusion at the outer wall of the battery bushing, as this protrusion acts as a reinforcement and allows absorbing of comparatively high forces without deformation of the battery bushing.

[0017] In a further embodiment, the mounting section has a decreasing material thickness starting from the torque ring to the end of the mounting section. A torque ring may also be called anti-twist protection or distortion lock protection. As the possible holding forces decrease towards the end of the mounting section due to the anchoring forces of the circumferential projections, the thickness of the walls can be reduced, thus saving further material and mass.

[0018] Another embodiment relates to a rechargeable battery having at least one battery bushing as described herein.

[0019] The planar upper supporting surface of the torque ring acts as supporting surface for the molding tool. The planar supporting surface has a circular shape and no breakthroughs from a top view. During the production process an injection molding tool fits to the planar upper supporting surface of the torque ring. The torque ring will be injection molded with a molding material, for example a plastic material. The form-locking support between the molding tool and the planar upper support surface of the torque ring prevents an overflow of the injection molding material. The planar upper supporting surface preferably has no irregularities and is flush with the surface of the injection molding tool.

[0020] The torque ring has a first section with a circular shape which is oriented towards the contacting section with a circular planar supporting surface, a second section with a circular shape adjacent to the first section which is oriented towards the mounting section with an outer contour having indentations. Furthermore the torque ring comprises a third section adjacent to the second section towards the mounting section which has a planar surface towards the mounting section and a circular shape. The first section, the second section and the third section preferably have the same diameter.

Description of Drawings

[0021] In the following the invention will be described by way of example, without limitation of the general inventive concept, on examples of embodiment with reference to the drawings.

Figure 1 shows a preferred embodiment of a battery bushing in a sectional view when overmolded in the lid.

Figure 2 shows a preferred embodiment of a battery bushing in a sectional view.

Figure 3 shows a preferred embodiment of a battery bushing in a side view.

Figure 4 shows a sectional view of a preferred embodiment when overmolded in the lid.

Figure 4b shows a sectional view of a preferred em-

bodiment when overmolded in the lid several parallel slots.

Figure 5 shows a surface cut of another preferred embodiment when overmolded in the lid.

Figure 6 shows a surface cut of another preferred embodiment when overmolded in the lid.

Figure 7 shows a surface cut of another preferred embodiment when overmolded in the lid.

Figure 8 shows a surface cut of another preferred embodiment when overmolded in the lid.

Figure 9 shows another preferred embodiment of a battery bushing in a sectional view with a concave shape of the lower section.

Figure 10 shows a detailed view of a preferred embodiment of a battery bushing in a sectional view when overmolded in the lid.

Figure 11 shows a preferred embodiment of a battery battery bushing in a sectional view when overmolded in the lid with a battery terminal post.

Figure 12 shows a preferred embodiment of a battery in a sectional view during the installation process with the therefore needed injection molding tool.

[0022] In figure 1, a preferred embodiment of a battery bushing 200 is shown. The battery bushing 200 has a contacting section 210 for contacting the battery to a vehicle or a formation connector, and a mounting section 212 for mounting and holding the battery bushing 200 within a battery cover. Between the contacting section 210 and the mounting section 212 is an annular base 204 with several indentation or recesses, which provides a high torque resistance to the battery bushing 200 through the encapsulation of material of the cover 300 or another encapsulation material 203 which fills the indentations. Preferably, the mounting section has at least one, preferably two circumferential projections 231, 232 to extend the way of the acid and to work as mechanical lock against vertical movement. The battery bushing 200 preferably is a hollow body, wherein most of the body, with exception of the torque ring, is rotationally symmetrical around a center axis 150. The torque ring may be symmetric to the center axis. The battery bushing 200 has an inner wall 201 and an outer wall 202. Preferably, the upper section 254 has a slightly conical shape with decreasing diameter to the top side 115 of the battery bushing 200. In an alternate embodiment, the inner wall 201 of the upper section 254 may be cylindrical. The lower section 255 may have a decreasing cross-section from the first circular edge 152 to the bottom side 114 of the battery bushing 200. The lower section 255 further may have a second circular edge 153 and a cone to improve the mountability.

[0023] In Fig. 2, a preferred embodiment is shown in a sectional view. Here, the mounting section 212 may have a labyrinth with two circumferential protrusions 231 and 232. The inner wall 201 has an upper section 254 and a lower section 255. In this embodiment between these sections, there may be a circular edge 152 or a step 154. This circular edge 152 or the step 154 between the sections is located opposite to the torque ring at the inner wall 201.

[0024] In Fig. 3, a side view of a first embodiment is shown. The torque ring 204 has several indentations or recesses 218, 219, 220. The indentations preferably have a parallel orientation 218, 219, 220. The torque ring 204 has a first section 205 with a circular shape which is oriented towards the contacting section 210. The torque ring 204 has a circular first planar supporting surface 208. A second section 206 of the torque ring 204 has a circular shape and is adjacent to the first section 205. The second section 206 is oriented towards the mounting section 212. The second section 206 has an outer contour having indentations 218, 219, 220. Furthermore the torque ring 204 comprises a third section adjacent 207 to the second section 206 and oriented towards the mounting section 212.The third section 207 has a second circular shaped planar surface 209 towards the mounting section 212. The first section 205, the second section 206 and the third section 207 preferably have the same diameter.

[0025] In Fig. 4 sectional view at a cutting plane 151 of a preferred embodiment is shown. The torque ring 204 has several indentations or recesses 218, 219, 220. The indentions are filled by plastic material 203 or by the material of the battery cover 300. Preferably the form of the indentations is nearly symmetric to the center axis 151.

[0026] Fig. 4a refers to the embodiment of fig. 4 and shows a first 610, a second 611, a third 612, a fourth 613 and fifth 614 slot as an extension of the recesses 218, 219, 220. The slots are approximately parallel. The slots 610 - 614 correspond approximately to the form of one half of a two part molding tool which is used during the production process.

[0027] In Fig. 5 a sectional view at a cutting plane 151 of a further preferred embodiment is shown. The torque ring 204 has several indentations 226, 227, 228 which are filled by some plastic material 203 or the material of the battery cover 300.

[0028] In Fig. 6 a surface cut at a cutting plane 151 of a preferred embodiment is shown. The torque ring 204 is endowed with several indentations 223, 224 which are filled by some plastic material 203 or by the material of the battery cover 300.

[0029] In Fig. 7 a surface cut at a cutting plane 151 of a preferred embodiment is shown. The torque ring 204 has a hexagonal shape.

[0030] In Fig. 8 a cutting plane 151 of a preferred em-

bodiment is shown. The torque ring has a plurality of indentations 221 and slopes 222.

[0031] In Fig. 9, shows an another embodiment with a torque ring at the outer wall 202 and a concave shape of the lower section 255 from the circular edge 152 or step to the bottom side 214 of the battery bushing 200 to the circular edge 152 or step 154.

[0032] In Fig. 10, a sectional view of a preferred embodiment of the battery bushing 200 is shown. Here again, a pin of a molding tool 400 is inserted for demonstration purposes. Due to the complete enclosure of the mounting section 212 by the material of the battery cover 300 or the encapsulation material 203, the thickness of the walls can be decreased. Therefore, it is preferred, if the thickness 234 of the wall at a first location between the torque ring and the first circumferential protrusion 231 is bigger than the thickness 235 of the walls between the first circumferential protrusion 231 and the second circumferential protrusion 232. The maximum thickness of the material of the battery cover at the inner wall of the battery bushing 200 is determined by the shape of the lower section and the pin of the molding tool. It preferably is in the range between 1 and 5 mm, most preferably 2 to 3 mm.

[0033] In Fig. 11, a first embodiment of the battery bushing 200 within inserted battery terminal post 500 is shown. The battery terminal post 500 is connected to the battery cells, which are located to the bottom side and not shown. At its top side, it will be heated to melt together with the battery bushing 200 and to obtain a gas-tight and electrically secure connection. The terminal post 500 has a diameter, which is slightly smaller than the inner diameter of the terminal. Preferably, the terminal post 500 has a cylindrical shape with a diameter less than the smallest diameter of the inner wall of the battery bushing. Most preferably, the diameter of the terminal 500 post is between 0.5 and 3 mm less than the diameter of the circular edge of the battery bushing 200.

[0034] In Fig. 12, a sectional view of a preferred embodiment of the battery bushing 200 is shown. Here again, a pin of a molding tool 400 is inserted for demonstration purposed and an injection molding tool is set on the contacting section 210. The first planar upper supporting surface 208 of the torque ring 204 which protrudes over the contacting section 201 is in contact with the molding tool 600. This prevent an outflow of injection molding material, for example plastic.

List of reference numerals

[0035]

114	bottom side
115	top side
150	center axis
151	cutting plane
152	first circular edge
153	second circular edge
154	step
200	battery bushing
201	inner wall
202	outer wall
203	plastic material
204	torque ring
205	first section
206	second section
207	third section
208	first planar upper supporting surface of the torque ring
209	second planar surface of the torque ring
210	contacting section
212	mounting section
214	bottom side of the battery bushing
215	upper side of the battery bushing
218	indentations of the torque ring
219	indentations of the torque ring
220	indentations of the torque ring
221	indentations of the torque ring
222	slope of the torque ring
223	indentations of the torque ring
224	indentations of the torque ring
225	hexagonal shape of the torque ring
226	indentations of the torque ring
227	indentations of the torque ring
228	indentations of the torque ring
231	first circumferential projection / protrusion
232	second circumferential projection / protrusion
234	thickness of wall between the torque ring and the first circumferential protrusion
235	thickness of wall between the first and second circumferential protrusions
240	arch-shaped cross section
241	arch-shaped cross section
254	upper section
255	lower section
300	battery cover
400	pin of a molding tool
500	battery terminal post
600	Injection molding tool
601	contact pressure
610	first slot
611	second slot
612	third slot
613	fourth slot
614	fifth slot

Claims

1. Battery bushing (200) for a battery having a hollow body, which has an outer wall (202) and an inner wall (201), further providing a mounting section (212), a contacting section (210) and a torque ring (204) at the outer wall (202) between the mounting section (212) and the contacting section (210),
the torque ring (204) having a first section(205) ori-

ented towards the contacting section (210) with a first circular planar supporting surface (208), a third section (207) oriented towards the mounting section (212) with a second circular planar surface (209), and
a second section (206) between the first section (205) and the third section(207) with an outer contour having indentations (218, 219, 220),
the first section (205), the second section (206) and the third section (207) having the same diameter,
the outer wall (202) preferably having at least one circumferential protrusion (231, 232) at the mounting section(212), forming a labyrinth,
the inner wall (201) having at least an upper section (254) which is surrounded by the contacting section (210), and
a lower section (255) being surrounded by the mounting section (212) and having an expanding diameter to an bottom side (214) of the battery bushing (200).

2. Battery bushing (200) for a battery according to claim 1,
characterized in, that
at least two indentations (218, 219, 220) are parallel slots (610, 611, 612, 613, 614).

3. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
the torque ring (204) protrudes from the outer wall (202).

4. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
the indentations (218, 219, 220) extend into the outer wall (202).

5. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
the upper section (254) has a conical or cylindrical shape with a decreasing diameter to a top side (115) of the battery bushing (200).

6. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
the mounting section (212) has a concave or conical shape with expanding diameter to a bottom side (114) of the battery bushing (200).

7. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
a circular step (152) or a circular edge (252) is at the inner wall within the torque ring (204).

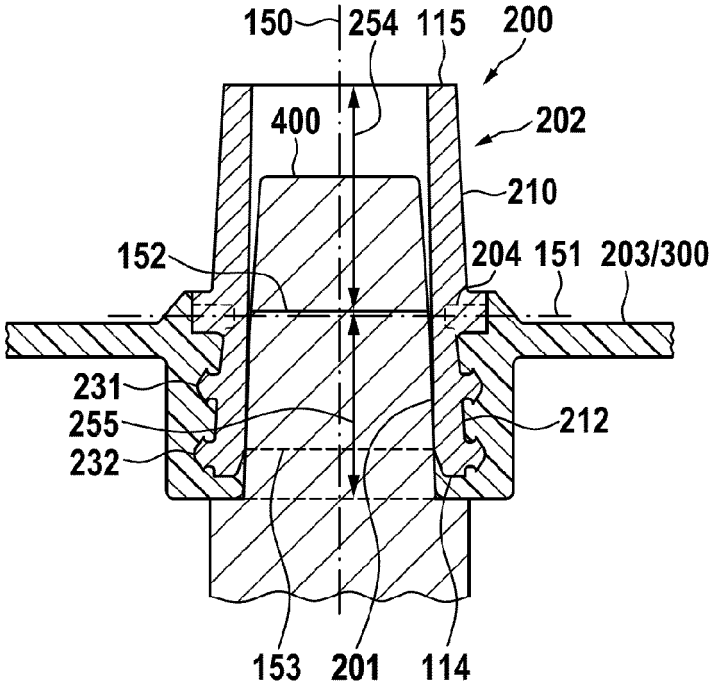
8. Battery bushing (200) for a battery according to any one of the previous claims,
characterized in, that
the mounting section (212) has a decreasing material thickness starting from the torque ring (204) to the end of the mounting section.

9. Rechargeable battery having at least one battery bushing (200) according to any one of the previous claims.

10. Rechargeable battery according to claim 9,
characterized in, that
the at least one battery bushing (200) is molded into a battery cover (300).

11. Rechargeable battery according to claim 9,
characterized in, that
the at least one battery bushing (200) is molded into an plastic material (203).

Fig. 1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204
151
203/300
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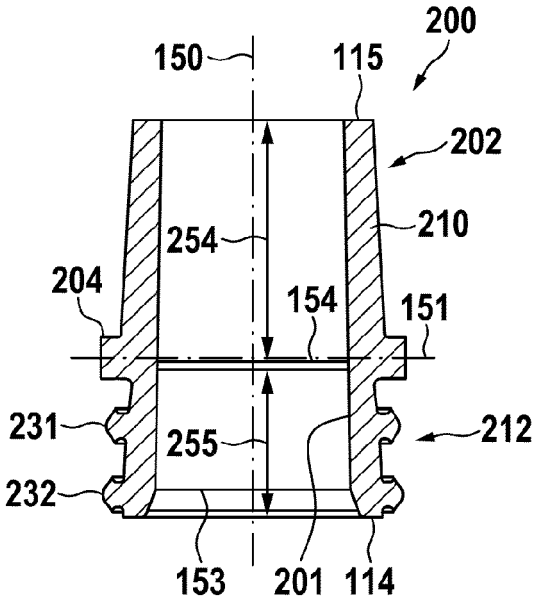
255
232
212
153
201
114

Fig. 2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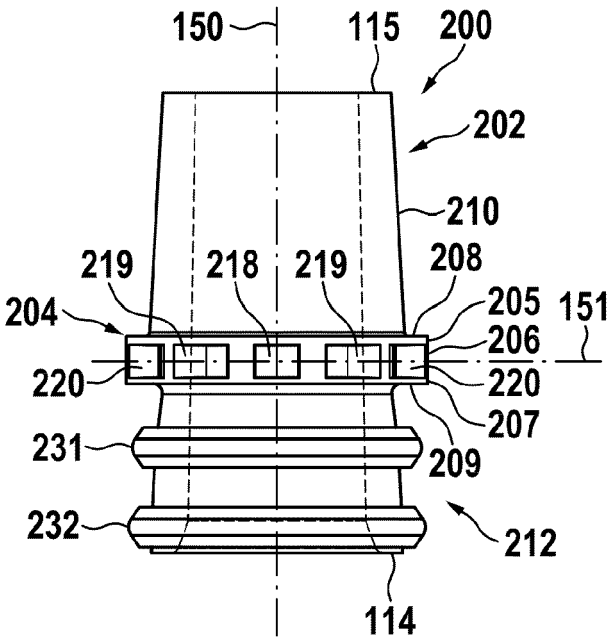
114

Fig. 3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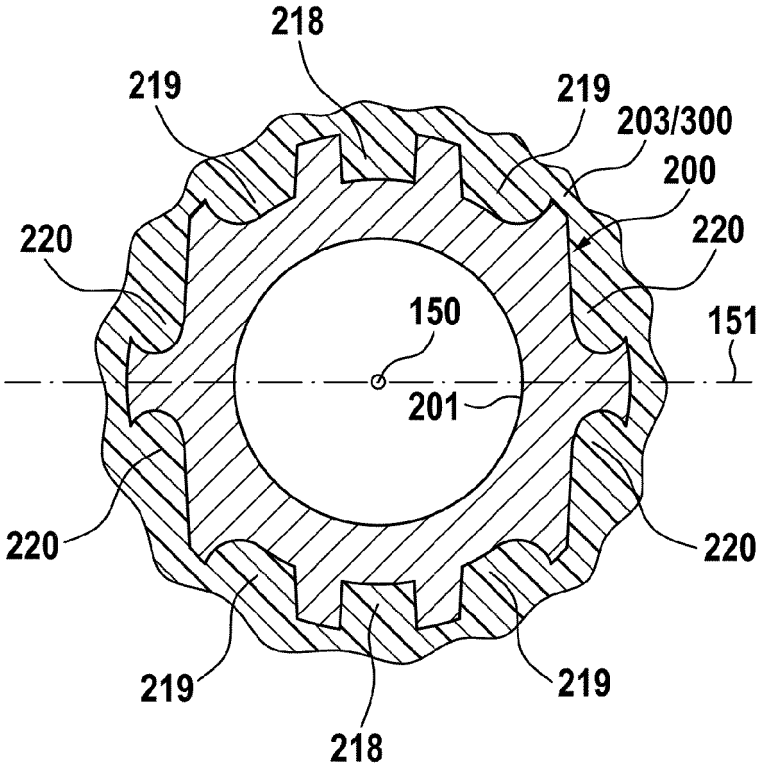
232
212
114

Fig. 4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203/300
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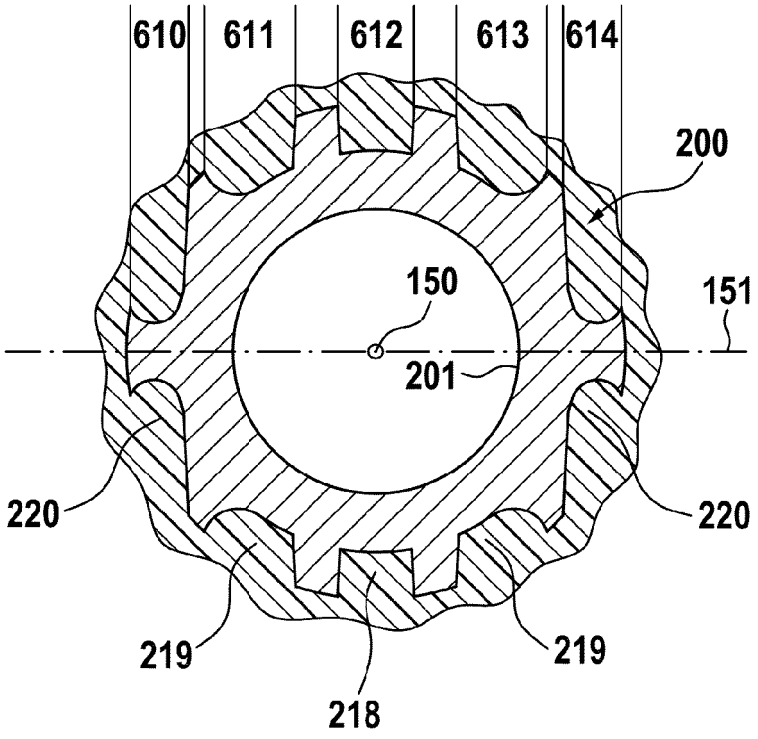
219
218

Fig. 4a


610
611
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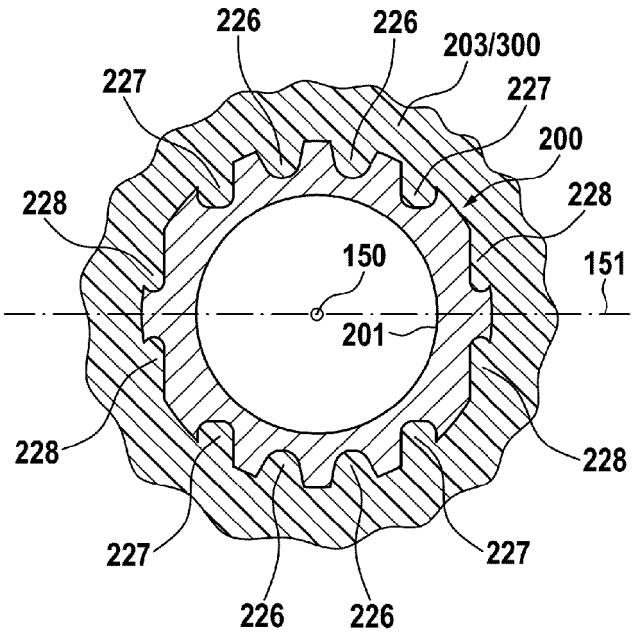
219
218

Fig. 5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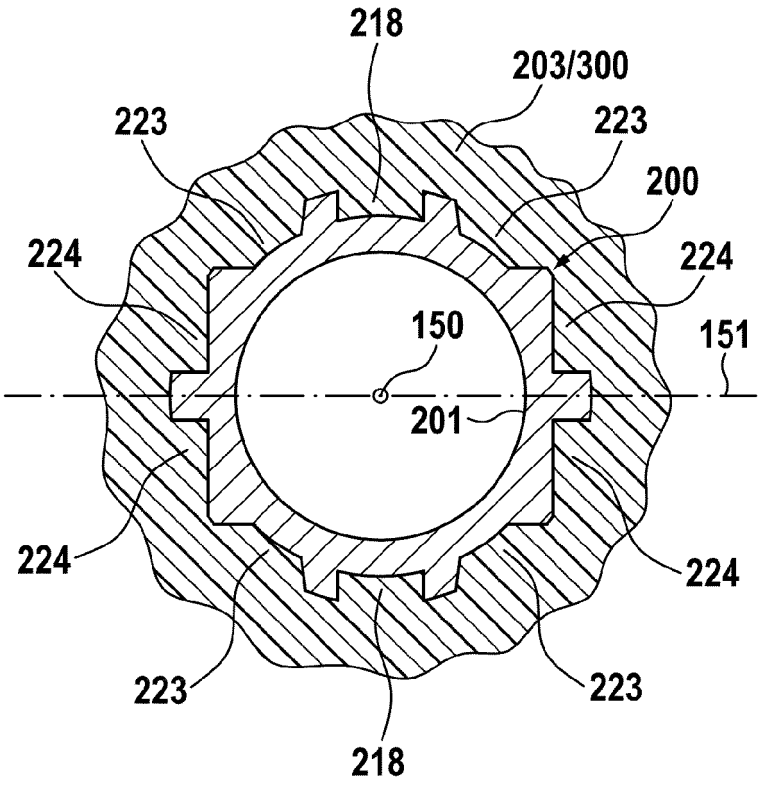
226
226

Fig. 6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203/300
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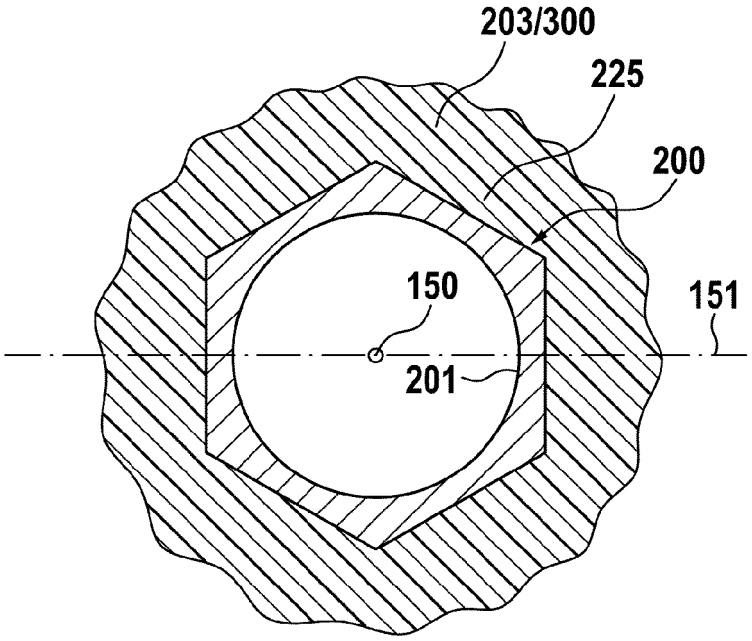
223
223
218

Fig. 7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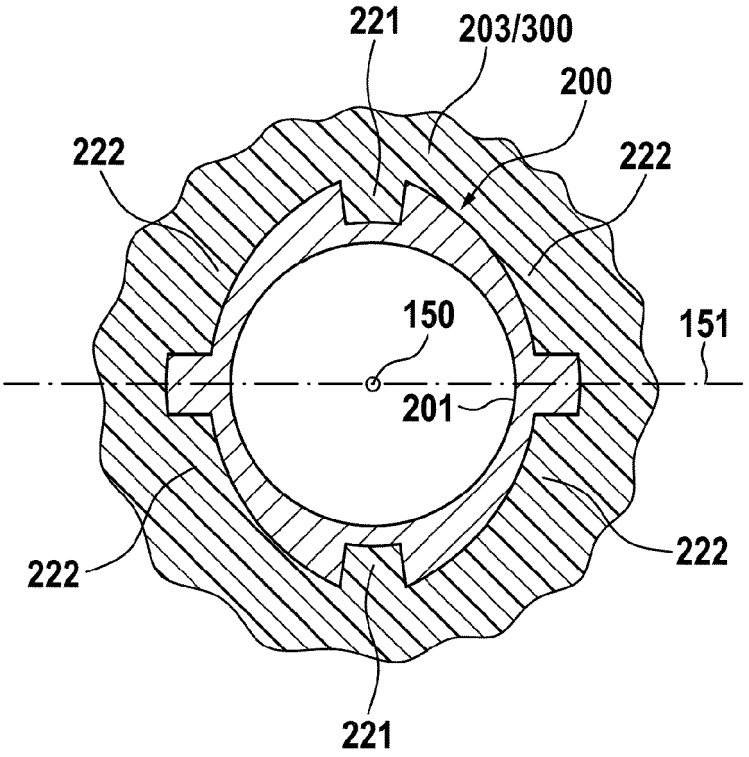
151
201

Fig. 8


221
203/300
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222
221

Fig. 9

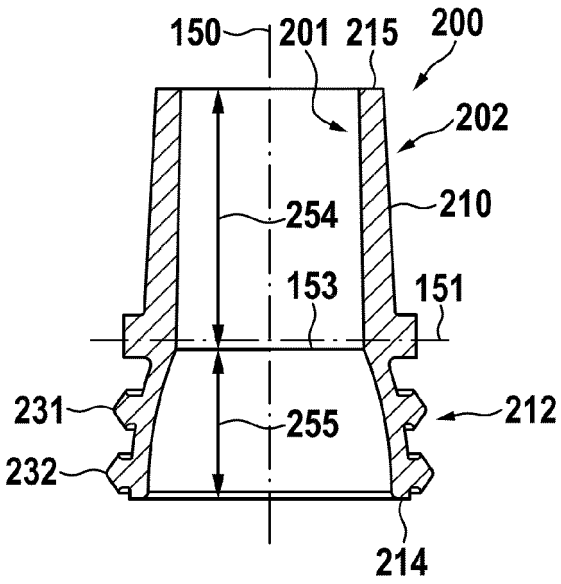


Fig. 10

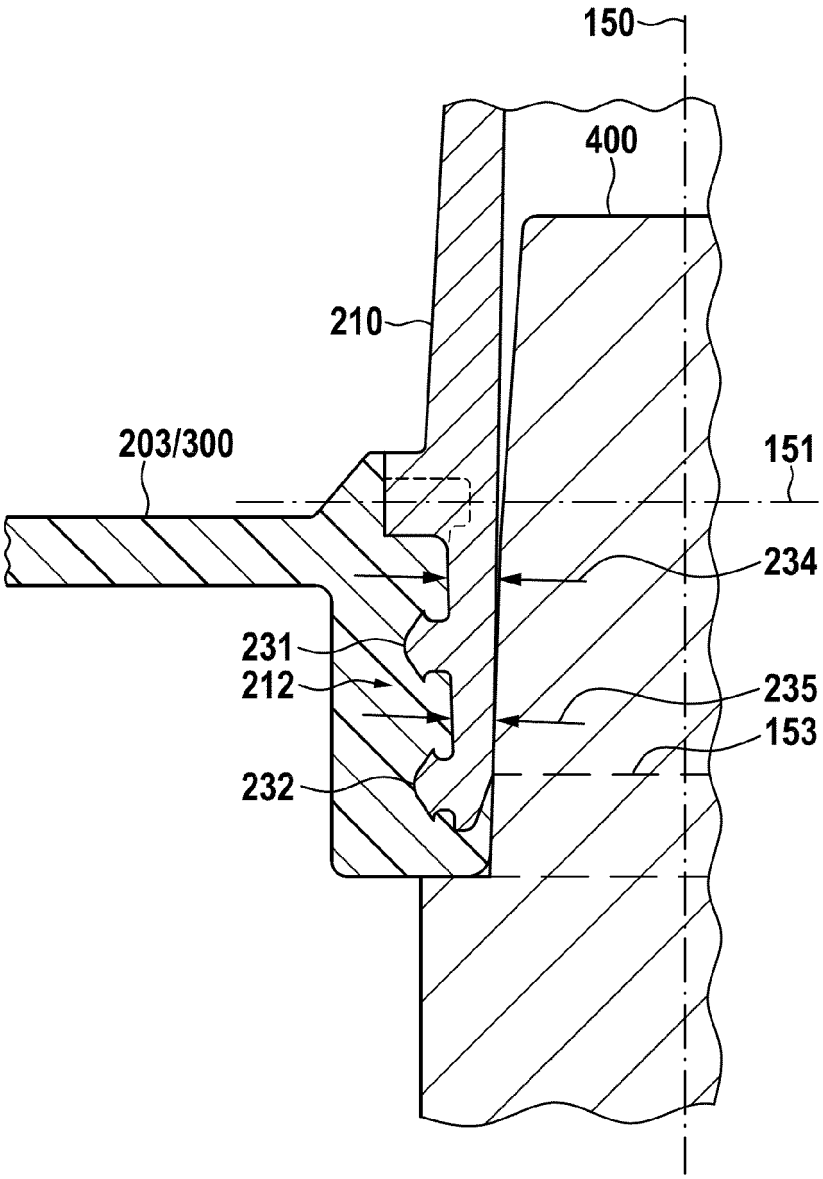


Fig. 11

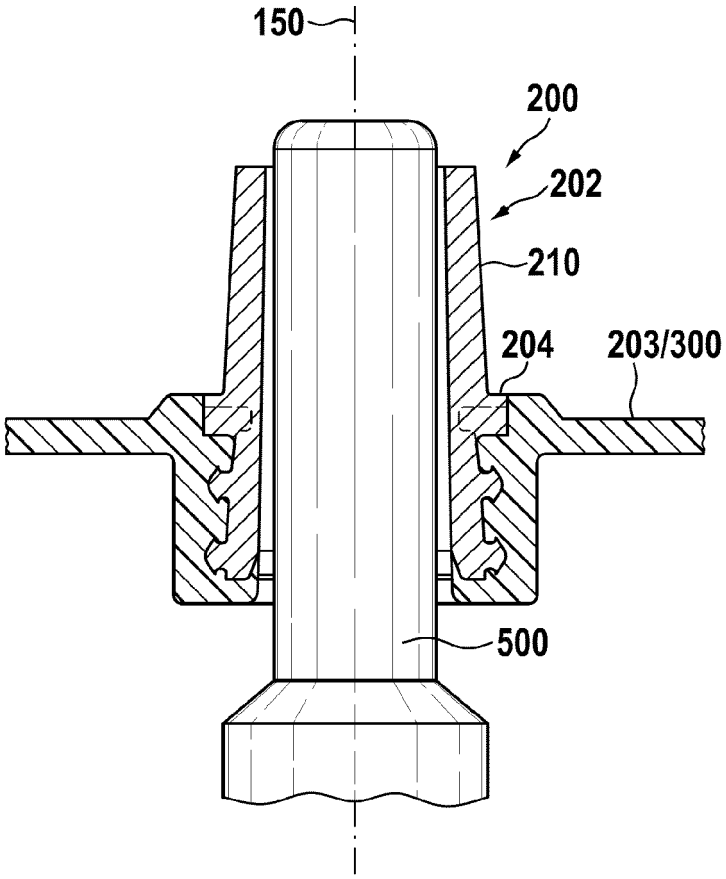
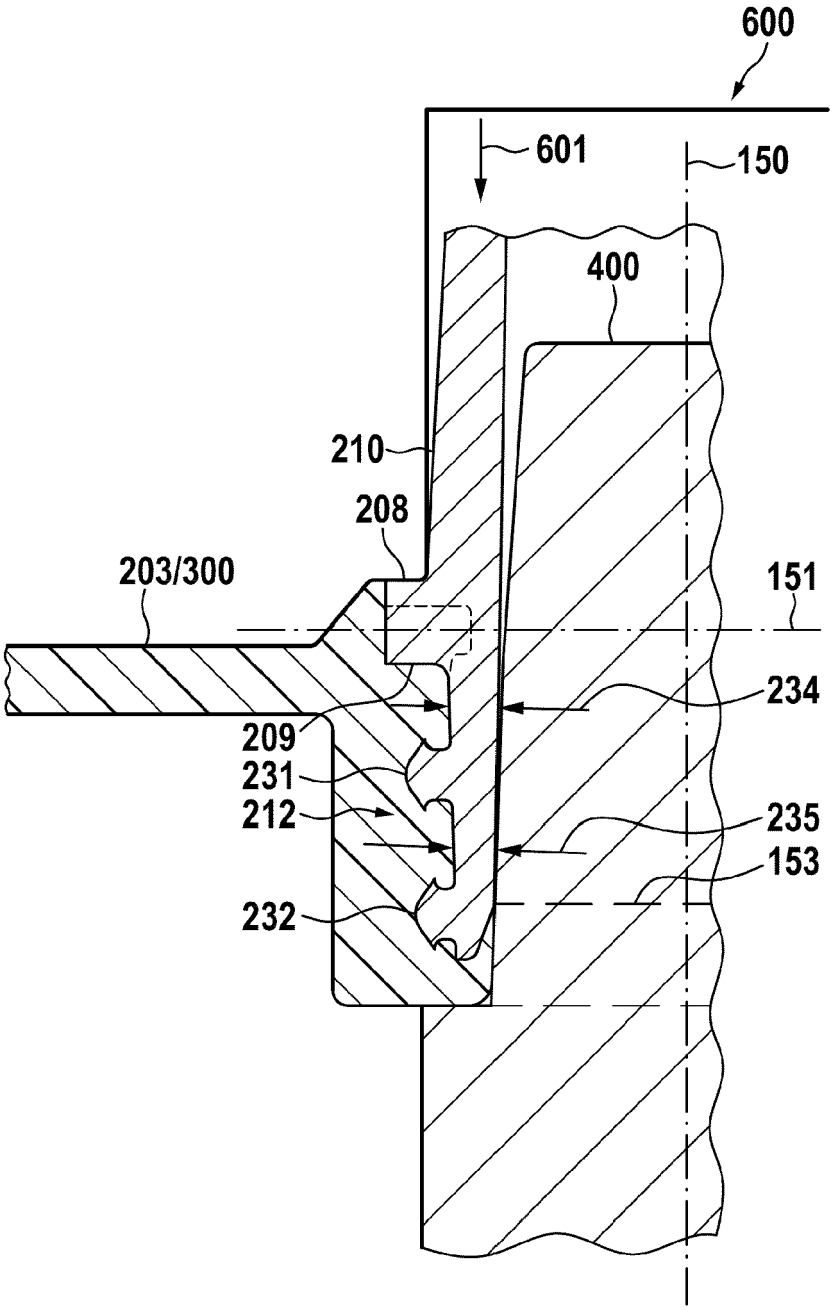


Fig. 12



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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 1701

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 420 300 A (ACCUMA PLASTICS LTD [GB]) 24 May 2006 (2006-05-24) * figures 2A-2D * * page 1, lines 4-6 * * page 4, lines 19-25 * * page 14, lines 6-24 * * claims 1,6 *	1,3-6,8, 9	INV. H01M2/30
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Place of search	Date of completion of the search	Examiner
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